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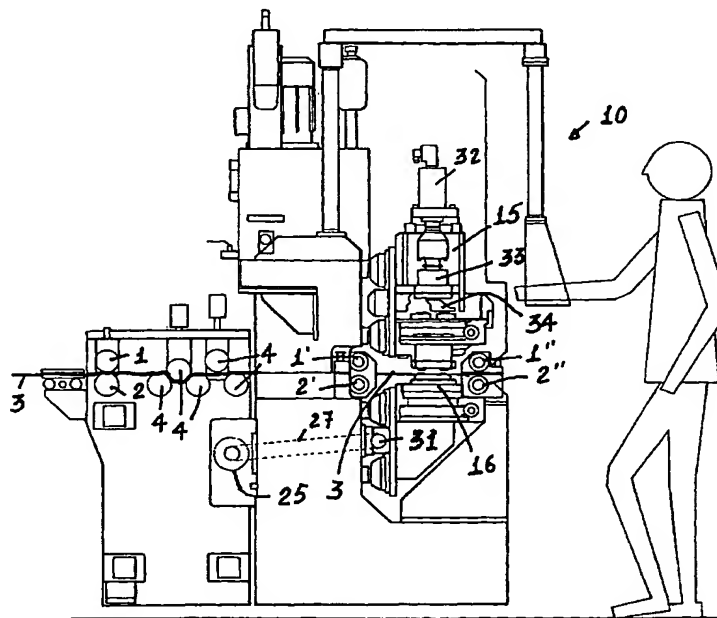
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[Continued on next page]

(54) Title: **APPARATUS FOR CUTTING AND NIBBLING A SHEET METAL IN COIL FORM**



(57) Abstract: An apparatus for cutting and nibbling a sheet metal (3) in coil form comprises pulling devices for pulling the sheet metal, which is delivered from a delivery bobbin or coil, and are driven by a pair of overlapping rollers (12), the sheet metal being adapted to intermittently advance, stop and move backward, the sheet metal being processed by machining heads (15,16), which are arranged at the top and bottom portions of the sheet metal and are designed for transversely move with respect to the sheet metal feeding direction.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

APPARATUS FOR CUTTING AND NIBBLING A SHEET METAL IN COIL FORM

BACKGROUND OF THE INVENTION

5

The present invention relates to an apparatus which has been specifically designed for cutting geometric patterns and performing drawing and marking operations.

10

Said marking operation, in particular, allows to mark, by a small incision, bending line trajectories or path arrangement.

15

The apparatus, moreover, allows to apply branding and code patterns, as well as allows to customize articles of manufactures by applying thereto signs such as logos, with a very high operating speed.

20

Apparatus for cutting and nibbling sheet metals are already known; however, in this prior apparatus, the sheet metal elements to be processed must be necessarily pre-cut in lengths or plates.

25

The cut lengths or plates, after the cutting operation, must be supported on processing surfaces, and then clamped by performing manual clamping operation, to allow the sheet metal length to be suitably driven with respect a pair of machining overlapped heads.

30

The latter, in prior apparatus of the above mentioned type, operate on a vertical fixed axis, thereabout said operating head can turn.

Thus, it should be apparent that the above mentioned machining operations must be necessarily

performed with a comparatively small operating speed, since it is necessary to perform preliminarily operations of loading, clamping the sheet metal elements on the processing surface, and then taking
5 and unloading the processed sheet metal elements one at a time.

Moreover, before the above mentioned operations, it is necessary to properly prepare the sheet metal elements, which must be formed from
10 strips or coils by using cutters for performing a plurality of cuts, thereby broad surfaces for accumulating and storing the precut sheet metal elements would be required.

15

SUMMARY OF THE INVENTION

Accordingly, the aim of the present invention is to provide an apparatus for cutting and nibbling a sheet metal in coil form, which allows to
20 greatly simplify the above mentioned machining operations, while directly using strip like sheet metal elements, as directly delivered from coils, without any need of pre-cutting the sheet metal elements.

25 Within the scope of the above mentioned aim, a main object of the present invention is to provide such a cutting and nibbling apparatus, which can process sheet metal elements with a very high processing or machining speed, thereby providing a
30 high processing yield.

Another object of the present invention is to provide such a cutting and nibbling apparatus

which can process sheet metal elements driven by pairs of overlapped rollers to be directly machined by overlapping operating head, designed for moving along a transversal operating direction.

5

BRIEF DESCRIPTION OF THE DRAWINGS

The above mentioned, and yet other features, of functional and constructional nature of the apparatus for cutting and nibbling sheet metal elements in coil form will become more apparent hereinafter from the following detailed disclosure of a preferred embodiment thereof, with reference to the figures of the accompanying drawings, where:

15 Figure 1 shows a side elevation view of the cutting and nibbling apparatus according to the invention;

Figure 2 illustrates a partial detailed view, on an enlarged scale, of the cutting and nibbling apparatus shown in figure 1; and

20 Figure 3 is a cross-sectioned top plan view illustrating the cutting and nibbling apparatus according to the invention.

25 DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the number references of the above mentioned figures, the cutting and nibbling apparatus according to the invention, which has been generally indicated by the reference number 10, is designed for processing strip sheet metal elements 3, as supplied by coils.

30

Said sheet metal elements, in particular, which are delivered by a bobbin or coil, are driven by pairs of overlapped rollers 1 and 2, 1' and 2', 1" and 2".

5 The apparatus 10 comprises moreover a plurality of offset rollers 4 provided for performing a series of folding and counter-folding operations, to provide the sheet metal element 3 in a perfectly flat condition.

10 The sheet metal element feeding movement is performed in a continuous manner, with intermittent feeding steps, stop steps and also backward movement steps.

 The device for unwinding the coil is
15 synchronized with the feed, stop and back movements of the sheet metal element 3.

 The apparatus 10 according to the invention comprises furthermore two beams 11 and 12, which are transversely arranged with respect to the sheet metal
20 feeding direction, at the top and bottom respectively of said sheet metal element.

 As shown, the beams 11 and 12 support cross guides 13 and 14, parallel to the first, which support the movable operating heads 15 and 16.

25 Said operating or machining heads, in particular, can be driven parallel to the beams 11 and 12 and in a cross direction with respect to the sheet metal element driving direction.

 Said operating or machining heads 15 and 16
30 can turn about a vertical machining axis, which can be transversely displaced, and being provided with a plurality of punch elements, arranged with a circular

arrangement, designed for cooperating with corresponding dies applied to the bottom head 16.

The machining heads 15 and 16 are rotatively driven by brushless motors 17 and 18.

5 The cutting and nibbling apparatus according to the invention also comprises a geared motor unit 19, the shaft 19' of which supports a toothed pulley 20, entraining a toothed belt 21.

10 The toothed belt 21, in particular, rotatively drives a second toothed pulley 22, keyed on the shaft 23.

 Said shaft 23, in turn, longitudinally drives the sheet metal element 3, by operating a pair of feeding rollers 1, 2, which are connected with
15 other pairs of feeding and pulling rollers 1', 2' and 1'', 2''.

 The brushless motor assembly 25 comprises a further toothed pulley 26, entraining a toothed pulley 27 thereon, said toothed pulley 27 in turn
20 rotatively driving a further pulley 28.

 The pulley 28, as shown, is keyed on a screw element 29 engaging with a scroll element 30, which operatively drives a top punch bearing head 15, by causing said head 15 to translate along guide
25 elements 13.

 The screw 29 cooperates with a second scroll element 31, which operatively drives the bottom die bearing head 16.

 The subject apparatus comprises furthermore
30 a hydraulic cylinder 32, which vertically drives a wing element 33 having, at the bottom thereof, an eccentric lug 34.

Said wing 33 selectively presses a punch element 36, which is radially arranged against the corresponding die therefor.

The wing 33, in particular, is adapted to
5 freely rotate, as entrained by the rotary head 15.

Thus, the wing 33, in its lowering movement, will engage the eccentric lug 34 in a cavity corresponding to the punch element 36 to be driven.

10 The wing 33 and its eccentric lug 34, engaging with a said punch element 36 are rotatively driven by the rotary movement of the head 15.

The feeding movements of the sheet metal element, as well as the cross translating movements
15 of the heads 15 and 16 and their rotary movements are controlled and timed or synchronized by a digital control central unit.

While the cutting and nibbling apparatus according to the present invention has been
20 hereinabove disclosed by way of a merely exemplary and not limitative example, it should be apparent that it is susceptible to several modifications and variations, all coming within the scope of the invention.

25 In particular, the apparatus according to the invention has been specifically designed for machining or processing a sheet metal element which is continuously supplied to said apparatus and which is provided in coil form.

30 In this connection, it should be apparent that the inventive apparatus, in addition to machining sheet metal elements, can also be used for

performing a plurality of different mechanical operations on different material coils or sheets, such as wood, plywood and multi-layer wood material, plastics material, aggregated materials or any materials in strip or sheet form.

Thus, it should be apparent that the cutting and nibbling apparatus according to the invention can be further modified and improved, and without departing from the spirit and scope of the invention.

CLAIMS

1. An apparatus for cutting and nibbling sheet metal elements in coil form, characterized in that said apparatus comprises pulling devices for pulling said sheet metal elements, which are delivered from a coil or bobbin and are driven by a pair of overlapped rollers (1) and (2), (1') and (2') and (1'') and (2''), and that said sheet metal element is adapted to be intermittently moved, stopped and moved backward, said sheet metal element being machined by a machining heads (15) and (16) which are arranged above and under said sheet metal element and can be transversely driven with respect to the feeding direction of said sheet metal element.

2. An apparatus, according to Claim 1, characterized in that said apparatus (10) further comprises a plurality of offset rollers performing a series of folding and counter-folding operations for providing said sheet metal element in a perfectly flat condition.

3. An apparatus, according to one or more of the preceding claims, characterized in that said sheet metal element is continuously fed, with intermittent feeding steps, stopping steps and backward moving steps.

4. An apparatus, according to one or more of the preceding claims, characterized in that said apparatus further comprises beams (11) and (12) supporting cross guide elements (13) and (14), parallel to said beams, and in turn supporting said movable machining heads (15) and (16).

5. An apparatus, according to one or more of the preceding claims, characterized in that said machining heads are driven parallel to said beams and transversely of the sheet metal element feeding direction.

6. An apparatus, according to one or more of the preceding claims, characterized in that said machining heads (15) and (16) can rotate about a machining axis which in turn can be transversely driven.

7. An apparatus, according to one or more of the preceding claims, characterized in that said machining heads (15) and (16) comprises a plurality of circularly arranged punch elements (36) cooperating with corresponding die elements applied to said bottom head (16).

8. An apparatus, according to one or more of the preceding claims, characterized in that said machining heads (15) and (16) are rotatively driven by brushless motors (17) and (18).

9. An apparatus, according to one or more of the preceding claims, characterized in that said apparatus further comprises a geared motor unit (19), said geared motor unit (19) having a shaft (19') supporting a toothed pulley (20) entraining a toothed belt (21).

10. An apparatus, according to one or more of the preceding claims, characterized in that said toothed belt rotatively drives a second toothed pulley (22), keyed on a supporting shaft (23).

11. An apparatus, according to one or more of the preceding claims, characterized in that said

shaft (23) longitudinally drives said sheet metal element, by driving the driving roller pair (1), (2) the rollers of which are coupled with the other pairs (1'), (2') and (1''), (2'') of feeding and driving
5 rollers.

12. An apparatus, according to one or more of the preceding claims, characterized in that said apparatus comprises a brushless motor assembly (25) having a toothed pulley (26) which entrains a toothed
10 belt (27) in turn rotatively driving a toothed pulley (28) keyed on a worm screw (29).

13. An apparatus, according to one or more of the preceding claims, characterized in that said worm screw (29) engages with a scroll element (30)
15 which operatively drives a top punch bearing head (15) so as to cause said head (15) to be translated along its guide elements (13).

14. An apparatus, according to one or more of the preceding claims, characterized in that said
20 screw (29) cooperates with a second scroll element (31) which operatively drives said die bearing bottom head (16).

15. An apparatus, according to one or more of the preceding claims, characterized in that said
25 apparatus further comprises a hydraulic cylinder (32) which vertically drives a wing (33) having, at a bottom portion thereof, an eccentric lug (34), and selectively pressing a radially arranged punch against a corresponding die element therefor.

30 16. An apparatus, according to one or more of the preceding claims, characterized in that said wing element (33) can freely rotate, as rotatively

driven by said machining head (15).

17. An apparatus, according to one or more of the preceding claims, characterized in that said wing element (33), as it is lowered, engages said
5 eccentric lug (34) in a cavity corresponding to a punch element (36) to be operated.

18. An apparatus, according to one or more of the preceding claims, characterized in that said wing element (33) and the eccentric lug (34) thereof,
10 engaging with a said punch element (36) are rotatively driven by the rotary movement of a said machining head.

19. An apparatus, according to one or more of the preceding claims, characterized in that the
15 movements of said metal sheet element and said machining heads are controlled and timed by a numeric controlling center unit.

20. An apparatus, according to one or more of the preceding claims, characterized in that said
20 apparatus can be used for performing like operations, by processing different materials, supplied in coil or sheet form, and comprising wood materials, plywood panel materials, multi-layer wood materials, plastics material panels or differently combined and/or
25 aggregated materials, and as broadly disclosed and illustrated in the preceding disclosure and in the figures of the drawings accompanying the subject Industrial Invention Patent Application.

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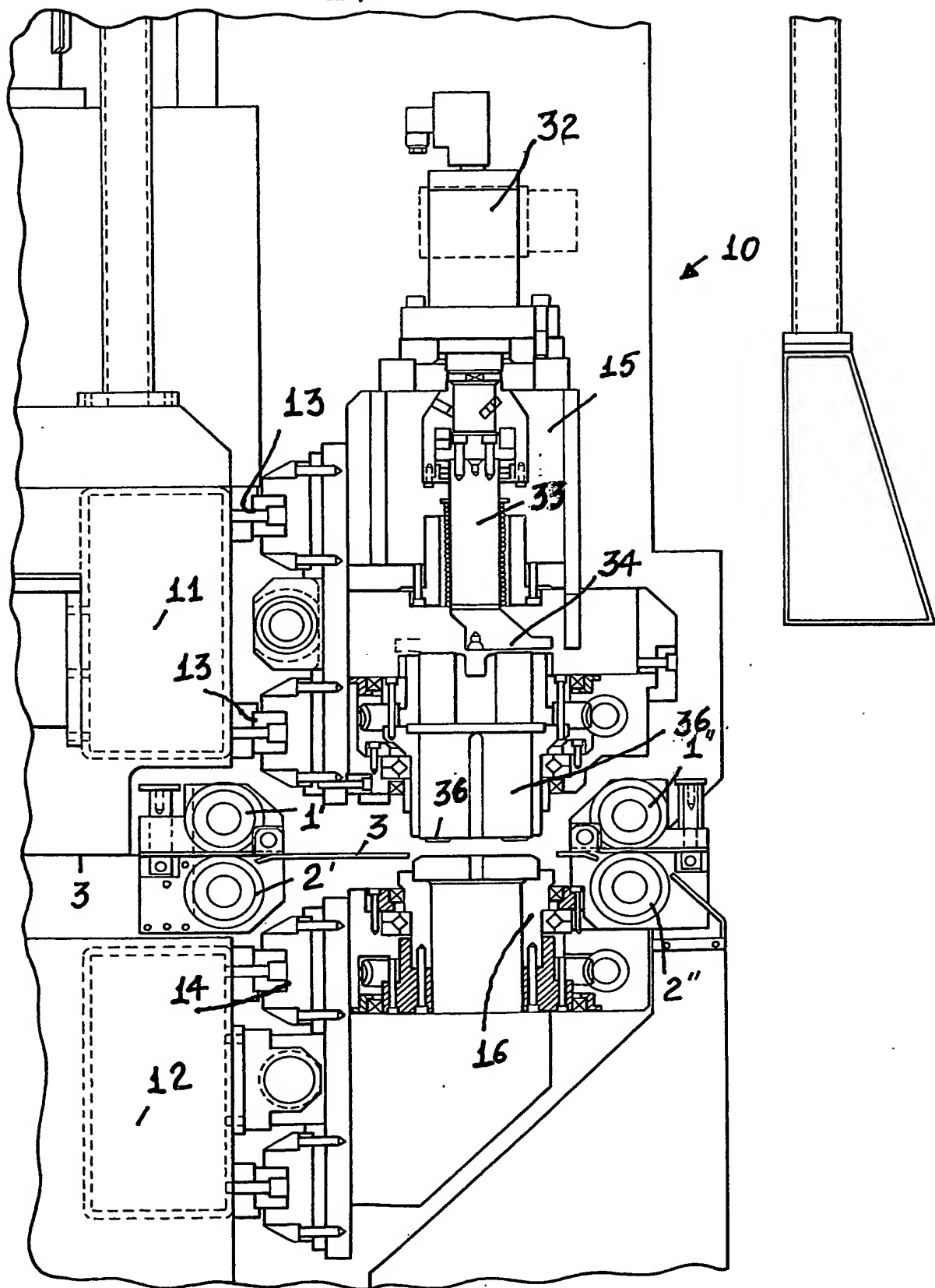


FIG. 2

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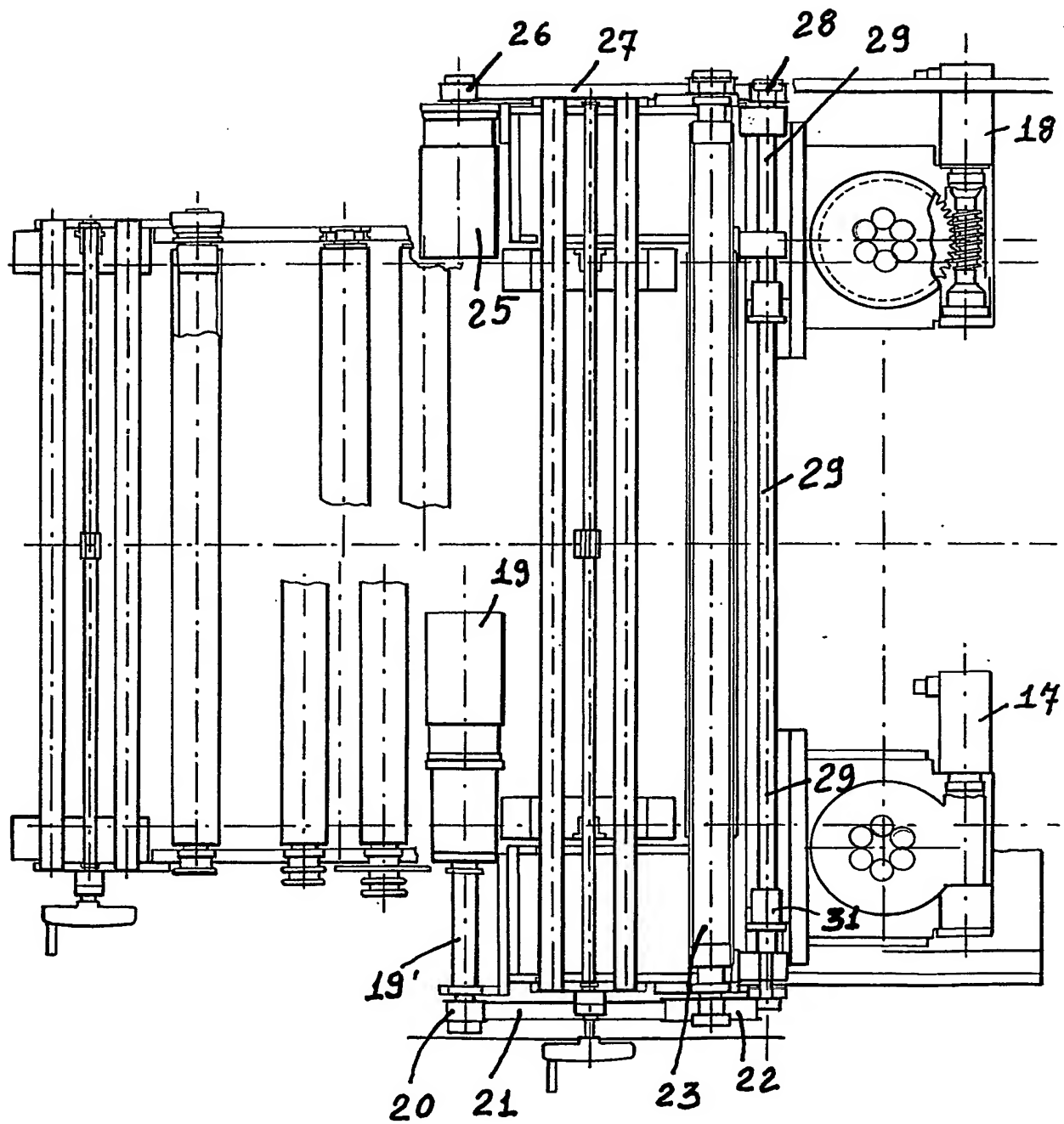


FIG. 3

INTERNATIONAL SEARCH REPORT

 Internat Application No
 PCT/IT 03/00236

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 B21D43/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PATENT ABSTRACTS OF JAPAN vol. 009, no. 303 (M-434), 30 November 1985 (1985-11-30) & JP 60 141342 A (ORII JIDOUKI SEISAKUSHO:KK), 26 July 1985 (1985-07-26) abstract	1-4
Y	US 3 124 290 A (LLOYD) 10 March 1964 (1964-03-10) column 6, line 27 - line 51	1-4
A	FR 2 471 231 A (WEINGARTEN AG MASCHF) 19 June 1981 (1981-06-19) page 5	1
A	US 4 761 980 A (MORIMOTO HIROYUKI ET AL) 9 August 1988 (1988-08-09) column 8	1
-/-		

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

20 August 2003

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28/08/2003

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INTERNATIONAL SEARCH REPORT

Internat_l Application No
PCT/IT 03/00236

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 86 01135 A (WORKMAN JOHN) 27 February 1986 (1986-02-27) the whole document -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internat Application No
PCT/IT 03/00236

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 60141342	A	26-07-1985	NONE	
US 3124290	A	10-03-1964	GB 942820 A CH 378634 A	27-11-1963 15-06-1964
FR 2471231	A	19-06-1981	FR 2471231 A1 SE 8008726 A	19-06-1981 13-06-1981
US 4761980	A	09-08-1988	JP 61199542 A JP 1657461 C JP 3014535 B JP 62097741 A JP 1657462 C JP 3014536 B JP 62097742 A JP 1648885 C JP 3014537 B JP 62104646 A CA 1274405 A1 DE 3678860 D1 EP 0196466 A2 US 4823577 A	04-09-1986 21-04-1992 27-02-1991 07-05-1987 21-04-1992 27-02-1991 07-05-1987 13-03-1992 27-02-1991 15-05-1987 25-09-1990 29-05-1991 08-10-1986 25-04-1989
WO 8601135	A	27-02-1986	AU 4637585 A BR 8506874 A DD 247617 A5 DK 163586 A EP 0190247 A1 ES 8705265 A1 WO 8601135 A1 IN 169683 A1 JP 61502949 T ZA 8505976 A	07-03-1986 09-12-1986 15-07-1987 10-04-1986 13-08-1986 16-07-1987 27-02-1986 07-12-1991 18-12-1986 26-03-1986